



Proprietary Trailer Design Product



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Introducing *Trailwell* Series

As a progressive small-to-medium scale trailer design company within its marketplace, APDICO has continually strived to find better solutions to satisfy its customers. With that, the company's designer focused on a proven design used successfully within the commercial truck and trailer industry. **Self-steer.**

Design background

Basic hitch trailer design has not changed since its inception, although trailer manufacturers have enhanced design over the years, adding braking systems, suspension and additional axles, it remained basically the same.

Small-to-medium scale utility and recreational trailers have utilized the traditional center-axle format as long as one can remember. Although the traditional design is well established, the design has inherent flaws. These flaws have been identified by manufacturers, as well as safety organizations such as the Department of Transportation (DOT) and insurance carriers.

The trailer manufacturing industry has hundreds of examples of unique, creative designs. Most of these manufacturers are small, to mid-cap manufacturers. Many of these manufacturers have experimented with designs solutions to compensate for the flaws in the center axle design. Most of these designs work to compensate for payload augmentation, while some solutions focus on steering improvement.

APDICO has recognized a trailer design that will revolutionize the pull trailer industry, and satisfy payload augmentation, as well as steering improvement, it's known as

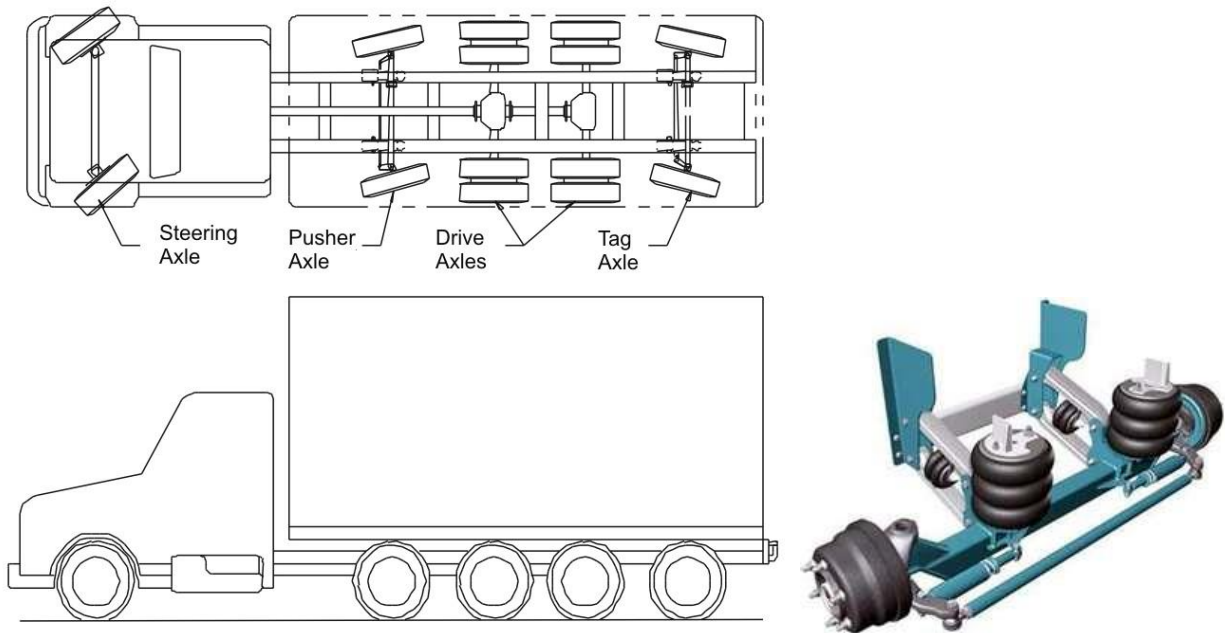
Self-Steer.

The design has been used successfully in the commercial trucks and trailers industries for years, and APDICO motivations are to introduce their improved design to the small, medium and commercial trailer industry.

This self-steering system will provide a more stable and safe platform for all bumper pull trailers. As a result of APDICO's proprietary design, this assembly is cost effective, easy to manufacture and can be produced with common trailer shop equipment.

Self-steer axles are in use in heavy equipment trucks such as dump trucks, Cement trucks, etc. They are used to increase the payload capacity of the truck by meeting the number of axles and GVW laws. These self-steer axles (auxiliary axles) are currently used in two ways, Pusher axle, where the axle is placed forward of the truck drive axle, and Tag Axle, where the axle is placed behind the truck drive axle.

These setups are also used in trailers, where the main tandem axle corresponds to that of the drive axles of a truck.



Generally, the auxiliary axles will bear the extra payload on the trucks and trailers, increasing its capacity, and tracks with the truck path at high speed, with braking capability, within the limitations of the Bridge law.

This concept was also used with special purpose semi-trailers. Those trailers were also equipped with similar Lift self-steer axles, as shown below.



Very few of the auxiliary axle systems are equipped with a caster reversing mechanism, so that the axle will track with the truck in the forward and reverse direction. Generally, the auxiliary axles will bear the extra payload on the trucks, increasing its capacity, and tracks with the truck path at high speed. These systems also include additional braking capability.

1- Bumper Pull fifth wheel and wagon setup:

There are two common methods of towing a trailer using fifth wheel wagon configuration.

- 1- The Fifth wheel king pin hitch, which is commonly used with converter Dolly. This is the most common semi-trailer hitch system.



Converter Dolly



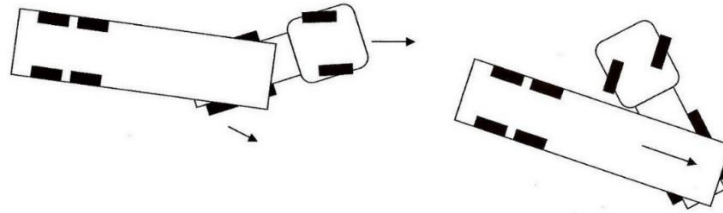
Truck - Semi-trailer hitch setup.

- 2- Permanent Fifth wheel wagon, commonly used in pup trailers, which is not detached through the life time of the trailer.

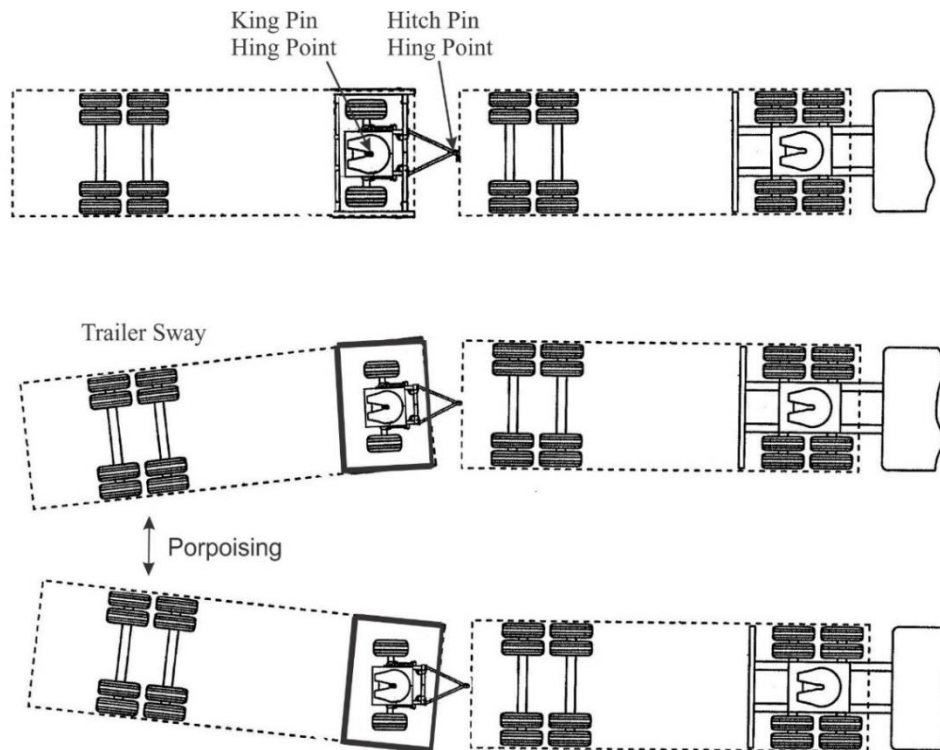


There are three main shortcomings of the wagon design described above:

- The first shortcomings, is that they have propensity for jackknifing in forward and reverse. Drivers have to address these maneuvers with skill.



- The second is sway and porpoising due to the presence of two pivot points, one is at the hitch point and the second is the fifth wheel king pin. Truck drivers are aware of these issues and receive training to compensate for and recover from them. The installation of trailer sway stabilizing system is also helping to evade accidents.



- The Third is the difficulty in reversing is also due to the presence of the two pivot points, as shown above, one is the hitch point and the second is the fifth wheel king pin. This is the reason, all truck routes are planned to avoid any need for reversing, such as re-fueling stations, docks, and depots.

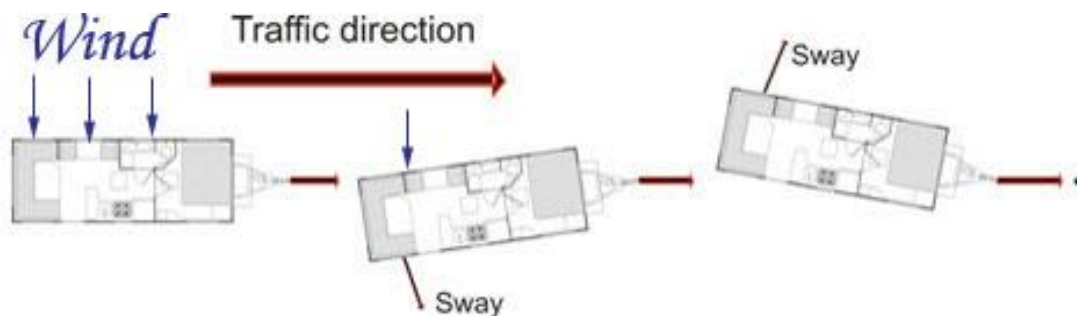
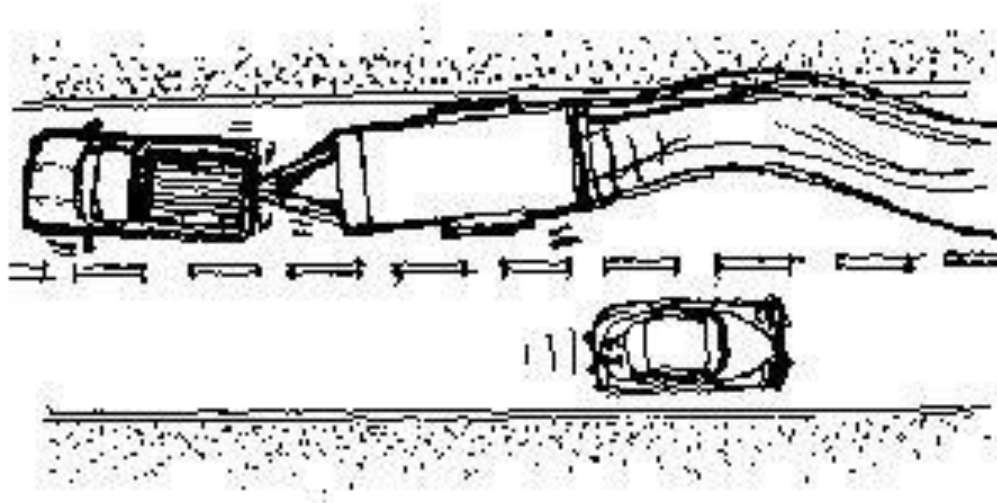
Standard 3-point trailer (Bumper Hitch):

This is the most common trailer configuration, which is used every day from hauling cars, equipment, furniture, mobile homes, and the list goes on.

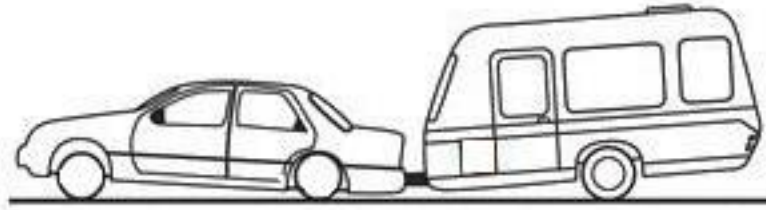


There are two main shortcomings of the bumper hitch design described above:

- The first shortcoming, is that they have a tendency to sway/porpoising.



- The Second and main shortcoming, is trailer tongue weight that consumes the equivalent value from tow vehicle payload capacity. Also, this will constantly be interfering with the tow Vehicle steerability, so weight distribution is critical to maintain tow vehicle level ride to maintain steering axle contact with the road.



On the other hand, if we observe an RV bumper pulling a free rolling motor vehicle, as shown below, there is no hitch vertical loading and the four tires contact on the ground gives it lateral stability. The answer was in plane site. The only problem is that you cannot reverse the towed vehicle without steering lockout. So, it is usually unhooked to reverse by itself, then re-hitched.



The concept of a trailer equipped with bumper pull and a front mounted self-steer axle system replicating a vehicle setup, would produce the same positive effects.

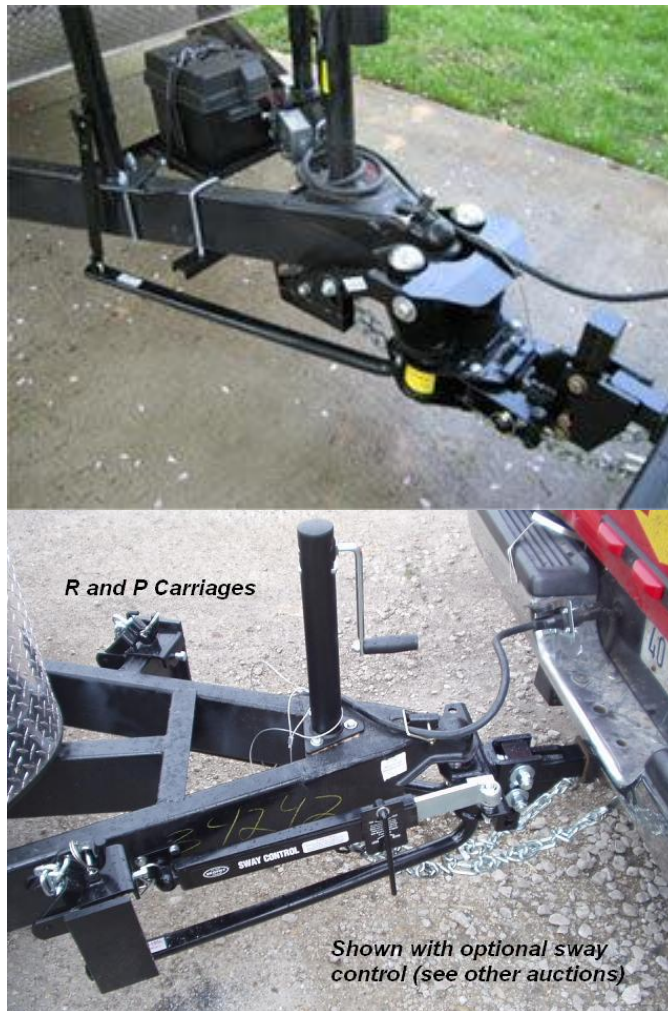
The trailer with front mounted self-steer axle will track with the towing vehicle in the same manner.

The next practical addition to the concept is reversing the axle caster to allow the trailer axle to track with the tow vehicle in reverse without steering lockout.

The overall result is a stable trailer that supports its own weight and due to the front self-steer axle tracking with the tow vehicle, it would minimize the jackknifing in forward and reverse.

Trailer Weight Distribution and Sway Control were developed and sold to compensate for these issues.

Example is: Pro Pride 3P (10,000#) (Price: \$2,445)



There are so many products out there to help with these issues, a Billion-dollar industry, yet they are only attempting to fix problems that are inherent with the 3-point design. Like that of semi-trucks and trailers shown above.

Self-Steer 5-point trailer Configuration

The Forward mounted Self-Steer Axle equipped trailers with Caster Reversing Systems developed by APDICO

The goal of Advanced Product Development, Inc. (APDICO) is to bring the trailer road handling performance to the 21st Century.

My following two self-steer inventions were developed in an attempt to make trailer leading self-steer axles main stream.

The idea of a bumper-pull trailer with a leading self-steer axle has been accepted for a long time, but no trailer manufacturer took it main stream, that I know of.

The custom bumper-pull self-steer trailer shown below, is the kind I usually see. The self-steer axle is not reversible, and hence, must always travel forward, and the coach driver must have an exit plan, when parking.



After researching the availability of a reversible caster self-steer systems, which can be placed on the front of a trailer, none were available. The only systems available were the ones mounted on trucks and trailers illustrated previously, as either tag and/or pusher lift axles, or as a fixed, non-lift non-reversible caster as shown above.

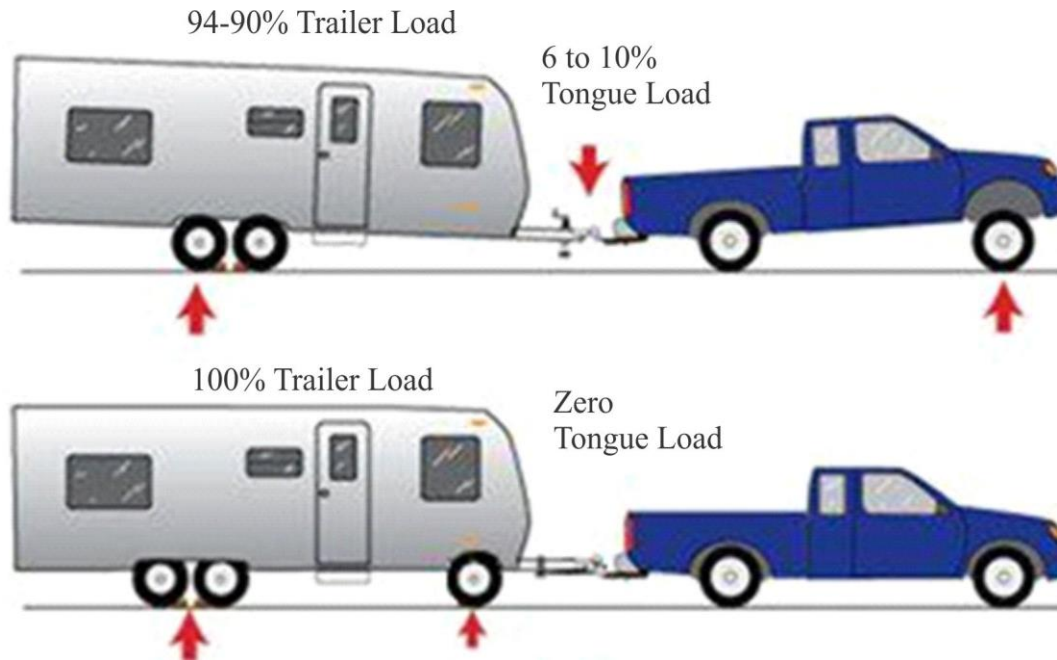
A forward mounted reversible caster self-steer system was needed to be invented

The Goals:

- Changes the old fashioned three-point trailer to a five-point trailer.
- The front self-steer axle tracks with towing vehicle in forward and reverse.
- Improved weight distribution (weight distributed over four points versus three)
- Increased safety (raises the roll-over threshold to that of the tow vehicle).

The Self-Steer System eliminates:

- Bouncing up and down
- Fishtailing / Porpoising, Crosswind instability.
- Jackknifing
- Zero Tongue Weight – now the tow vehicle can carry its full allowable gross weight while towing its full allowable tow weight.



The invention design concept was to take a self-steer axle, which is pivotally attached to a suspension system. The steering axle caster angle is changed by simply tilting the axle in one direction or another. The tilting angle with respect to the vertical is usually between 5 to 7.5 degrees.

The Axle Caster Reversing System allows the steering Axle to be changed by one of the following ways:

- a) Electric actuator,
- b) Pneumatic Actuator,
- c) Or Hydraulic Actuator.

Over the past 16 years, the First Generation of front mounted reversible caster self-steer systems and trailers were Invented and designed by ADICO, then later collaborated in developing, patenting, manufactured and sold under two separate companies and trademarked brands.

The First was **Steerite, Inc.** and Second is The Smart Wagons, Inc.

The **Steerite** design was based of concept of pivoting the platform, on which the self-steer axle and suspension system was mounted. This produced a self-steer axle with positive caster during the trailer forward travel.

When the platform is pivoted backwards, this produced a self-steer axle with negative caster during the trailer reverse travel.

The **Smart Wagon** design concept was based on pivoting the saddle type hinging of the self-steer axle. In this design, the axle is actuated directly to create the positive caster and negative caster as needed, during the forward or reverse travel of the trailer.

Disadvantages of general-purpose trailer:

Most general-purpose trailers consist of a load bearing axle or multiple of axles centrally located on the trailer to carry 90% of gross vehicle weight. And 10% tongue load that is carried on the truck hitch.

Trailers GVW varies from 2,000 lbs. to 12,000 lbs. that could be pulled by most trucks or SUV's. The ball hitch would be loaded to 800 lbs. for an 8,000 lbs. trailer, as an example. Initially, we surmise that the truck or SUV lost 800 lbs. of payload capacity for the purpose of pulling the 8,000 lbs. trailer.

Tongue load on the hitch causes the truck or SUV to tilt back, reducing the weight on the truck or SUV steering axle. This will also reduce the braking and directional control. It is usually corrected with the addition of a booster spring on the truck or SUV rear axle.

The rollover threshold of a general-purpose trailer is lower than that of a truck or the SUV, and extra care must be exercised during cornering. Side wind also influences the lateral stability, which leads to fishtailing. Ramps, however small, could cause the front jack and rear bumper of the trailer to strike the ground.

Advantages of Proprietary Trailer Design

Trailers GVW varies from 2,000 lbs. to 8,000 lbs. that could be pulled by most trucks or SUV's. With the use of the Caster Reversing Axle Pivoting Platform System, the drawbar assembly will be free to pivot, on the vertical plane hence removing the tongue load, and returning the payload capacity to the truck or SUV.

Consider a 10,000 lbs. capacity RV trailer with a tongue load of 1,000 lbs., that is no longer a problem. Lighter suspensions can now be used; even lighter trucks can pull the trailer.

Removing the tongue load on the hitch causes the truck or SUV not to tilt back, eliminating the need for the addition of a booster spring, airbags, and trailer stabilizers on the truck or SUV rear axle. The vehicle rollover threshold is then increased, which will ultimately increase lateral stability of the suspension.

Ramps and steep driveways no longer present a problem, since the new style trailer will behave just like the truck or SUV.

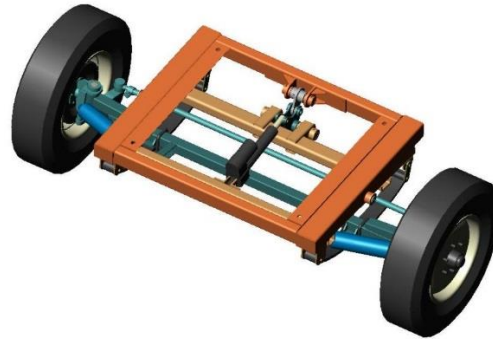
This system can be applied to any trailer type, duty or capacity. Uses cover utility trailers, RV trailers, auto-transporters trailers, boat trailers, boxed trailers, etc.

The reversing caster mechanism is activated when the truck is put into reverse. The reverse light electric system will power the unit. This makes the change over from forward to reverse natural, easy and fool proof.

The caster changing assembly is independent of the suspension system type Self-Steer Axle. It could be used with different suspension systems. These include leaf springs, air springs suspension, and trailing arm suspension Self-Steer Axles.

FIRST GENERATION SELF-STEERS

First Design: Reversible Caster Pivoting Platform self-steer system (Patented):



In 1998, in collaboration with Auto Transport, LLC, Fontana, CA, my First invention of a new type of trailer leading self-steer system was developed. After extensive testing, and prototyping, the design was completed and patented, and the Production of many trailer types ensued.

Here is an example of a car hauler equipped with a reversible caster self-steer system built by Steerite in 2002.



The Steerite Self-Steer system was qualified as **Light Duty**, with the Self-Steer Axle Capacity of up to 2,500 Lbs., combined with 10K tandem producing a Gross Trailer Weight rating of up to 12,500 Lbs. This allows it to be towed by an SUV or any half ton truck.

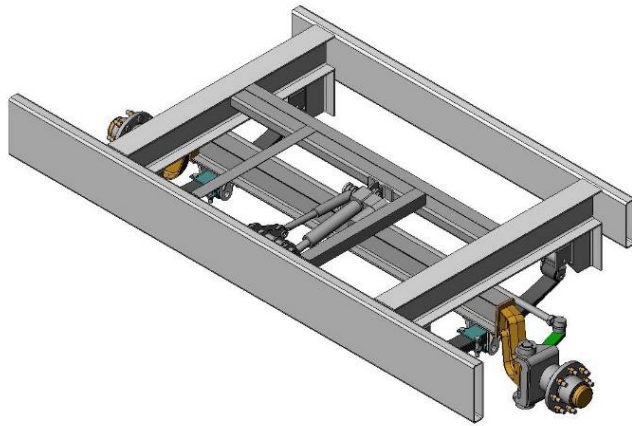
See web site: <http://apdico.net/> under STEERITE tap to see them in action.

More Examples of Steerite Trailers are illustrated in "Appendix A".

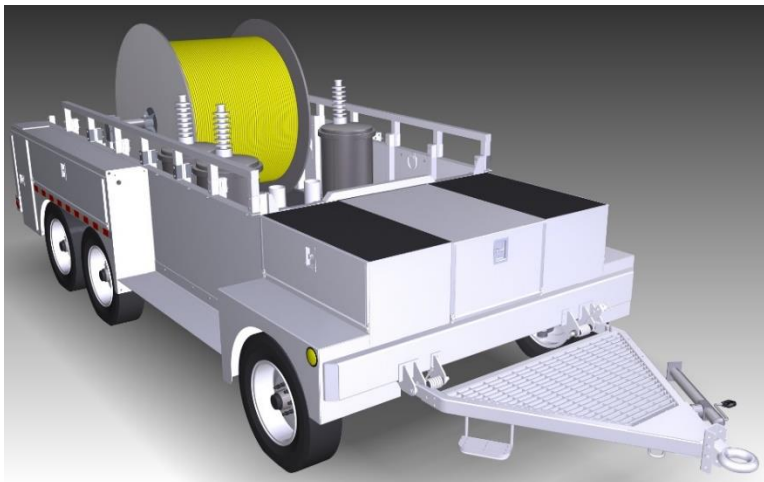
Lippert Components in 2004 expressed interest in this design during a presentation by Steerite at the time. An agreement was not reached. Steerite was disbanded since. APDICO retained the invention.

FIRST GENERATION SELF-STEERS

Second Design: The Smart Wagon, Reversible Caster Saddle type self-steer system: (Patented)



In 2009, I introduced my Second reversible caster self-steer system to Techsys Chassis, Enloe, TX. and in collaboration with them, the new self-steer system was developed, as before. After extensive testing, and prototyping, the design was completed and patented.



The Smart Wagon company was formed to manufacture and market the new trailer design. (See Appendix B).

The Smart Wagon company out of Enloe, Texas is currently producing Mid. Duty utility trailers, with the Self-Steer Axle Capacity of up to 5,000 Lbs., combined with 16,000 Lbs. tandem axles capacity producing a Gross Trailer Weight rating of up to 21,000 Lbs. This allows it to be towed by any HD Utility Truck or similar capability.

See web site: <http://apdico.net/> under THE SMART WAGON tap to see them in action.

Also, you can Visit: www.smartwagons.com

Second Generation Reversible caster Self-steer systems

During the past 16 years, and while designing and upgrading both reversible caster self-steer systems and trailers illustrated above, a list of data assimilation is listed below:

- 1- Manufacturing practices,
- 2- Assembly procedure,
- 3- Inventory control,
- 4- JIT options,
- 5- System design performance,
- 6- Steerability / Trailer road worthiness Field test performance data,
- 7- Reversibility performance,
- 8- Customer feedback,
- 9- System failure analysis.

This led to the creation of two new systems.

The First is a marked improvement on the pivoting platform design and allowed increased rating version from 2,500 to 6K Lbs. (1.3 to 3 metric Tons).

The Second was designed to work in place of a fifth wheel or convertor Dolly. Rating between 8 to 12,000 Lbs. (4 to 6 metric Tons).

SECOND GENERATION SELF-STEERS

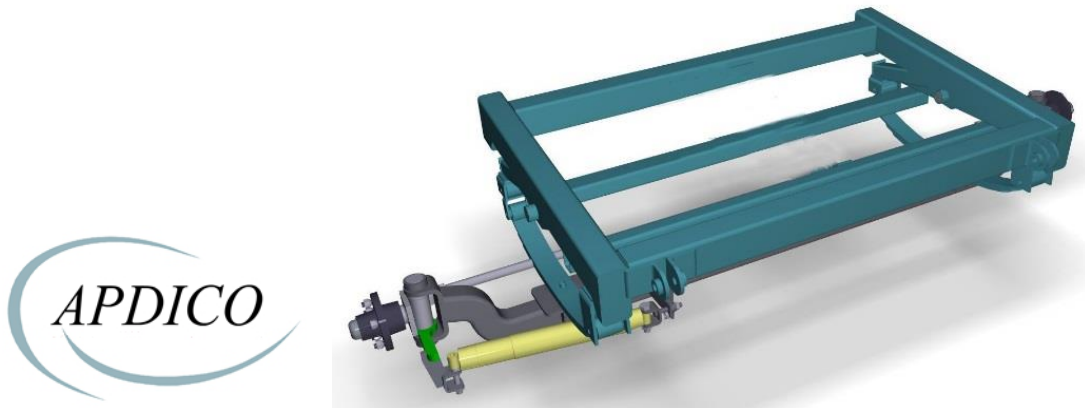
First Design: *Trailwell-LD* self-steer system:

This is an updated and **modified version of the** Pivoting Platform design.

This was based of concept of pivoting the platform, on which the self-steer axle and suspension system was mounted. This produced a self-steer axle with positive caster during the trailer forward travel.

When the platform is pivoted backwards, this produced a self-steer axle with negative caster during the trailer reverse travel.

This new Reversible Caster Self-Steer axle system, was designed based on all the data accumulated above. Making this latest design more practical, cost effective and efficient than previous designs, from manufacturing through to performance.



(Details omitted)

See Appendix C for an example application of this design.

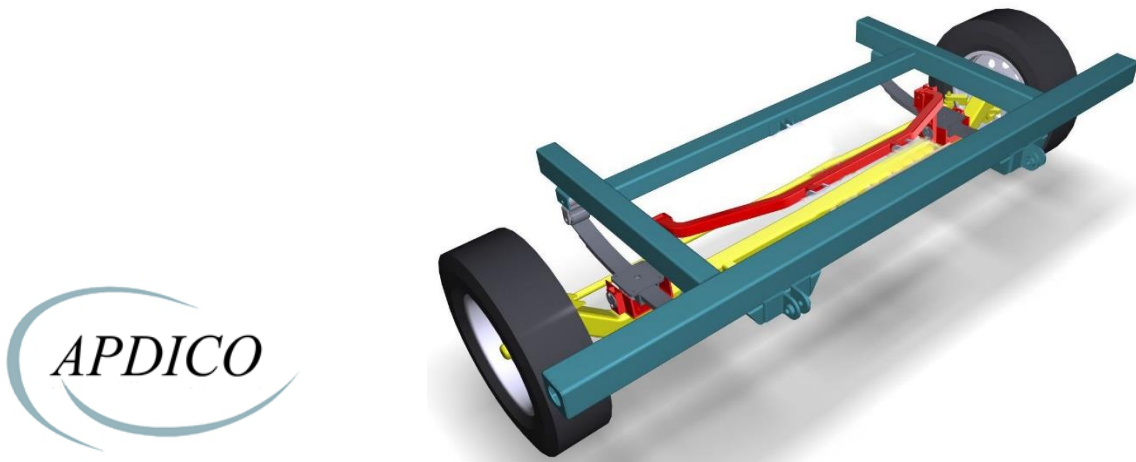
This upgraded design can be used as per Appendix A examples, and perhaps those in Appendix B.

The improvement is mainly structural flexibility, manufacturing procedure and actuator isolation setup to relief it from road feedback punishment.

Second Design: *Trailwell-HD* self-steer system:

The Second design was designed to work in place of a fifth wheel or convertor Dolly.

This Self-Steer Axle system will have multiple Capacities, varying between 8,000 to 12,000 Lbs., combined with tandem axles from 24 to 34K capacity producing a Gross Trailer Weight rating from 32K to 46K Lbs. This design also has a built-in lateral stabilizer System that is preferred with commercial trailers.



(Details omitted)

See Appendix D for an example application of this design.

The shown model in Appendix D, is an example for a 30Ft trailer rolling frame equipped with a forward reversible caster self-steer running gear at 8K rating.

This Self-Steer Design is specifically tailored for companies with specific manufacturing capability.

Synopsis

It has been a 16-year journey attempting to make the trailer with leading self-steer axle the latest innovation in trailer performance and stability of design.

What is required is a global truck and trailer manufacturing company that would spearhead the movement to thrust the leading self-steer trailers into the main stream.

These products need to be aggressively Marketed and advertised nationally and globally, namely Europe, in every trailer and auto shows, to achieve maximum visibility.

The European urban deliveries are usually made with trucks and wagon trailers (Pup), but due to difficulty of back tracking of the wagon trailers, they are only used in open ended roads.

Another factor is that the system can be retrofitted with the self-steer sub-frames.

Attachments

APPENDIX A: Steerite Gallery.

APPENDIX B: The Smart Wagon Gallery.

APPENDIX C: The [Trailwell-LD](#) Samples.

APPENDIX D: The [Trailwell-HD](#) Samples.

APPENDIX A: Steerite Gallery



Pivoting Platform Reversing Caster
Self-steer System (2000-2004)







Cementation Curbing Trailer



Problem:
Excessive tongue
weight of 1,800 Lbs.

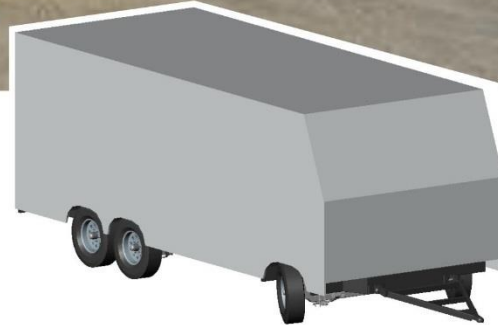
Solution:
Leading Self-Steer system
resulting in Zero tongue weight.

**Field Testing resulted in excellent
stability.**

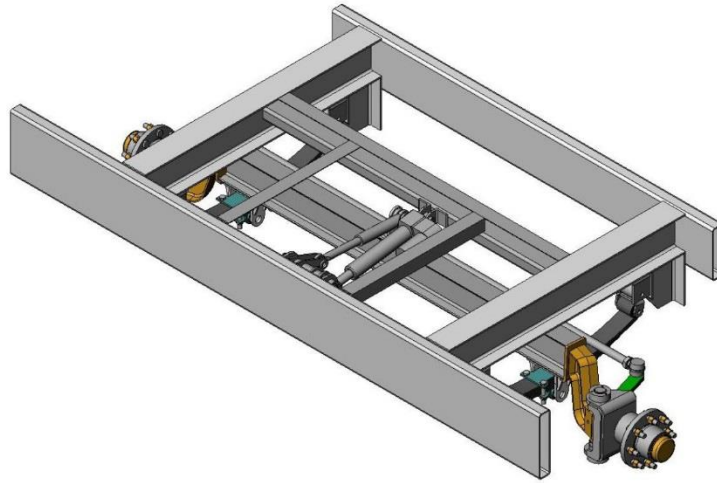




Generic Box Trailer



APPENDIX B: The Smart Wagon Gallery



Saddle Type Reversible Self-Steer System
(Patented)



www.smartwagons.com





HD. Material Utility Trailer

**More Examples of Versatility of
The self-steer trailer**



**Saddle type Reversing Caster
Self-steer System (2010)**

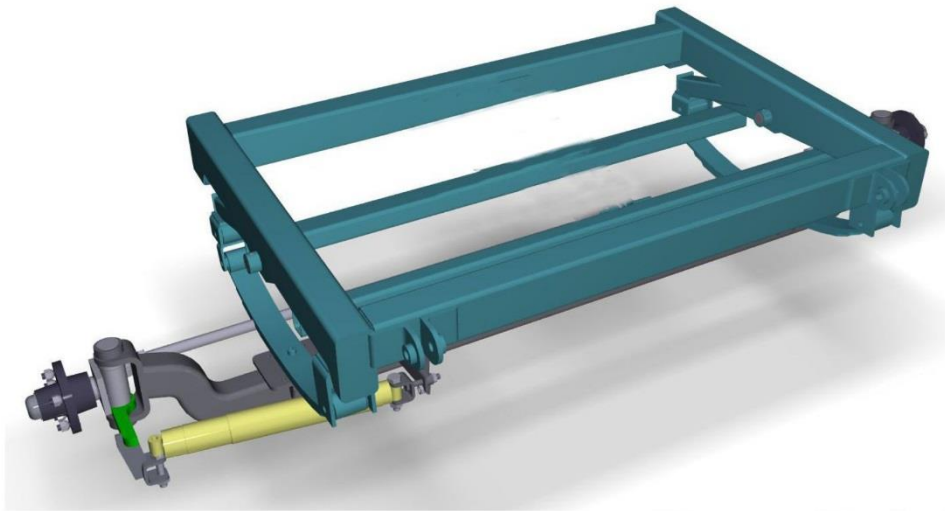




More Examples of Versatility
of The self-steer trailer

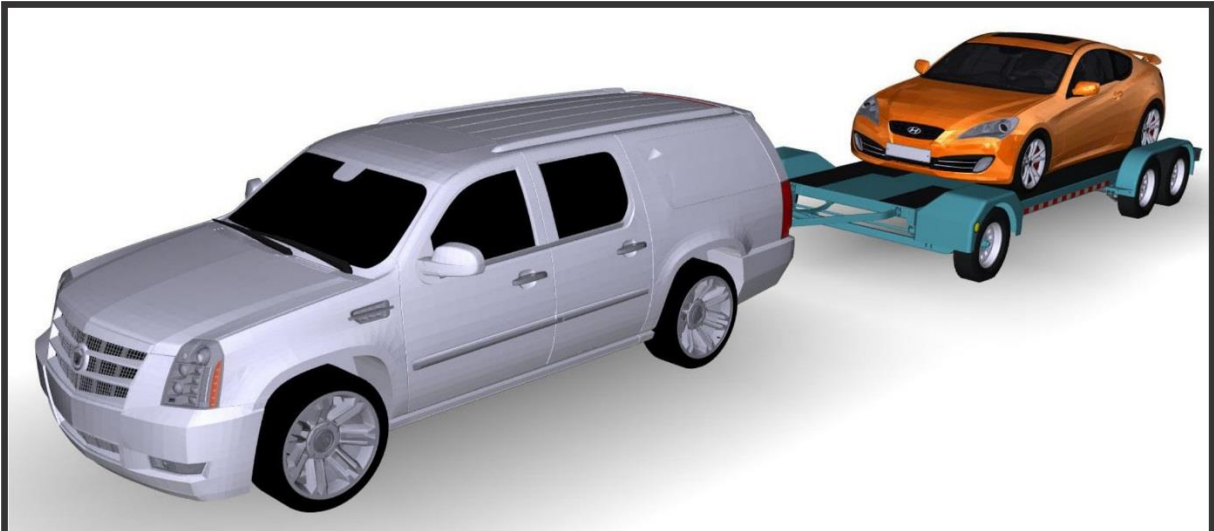


APPENDIX C: The *Trailwell-LD* Samples



Trailwell-LD



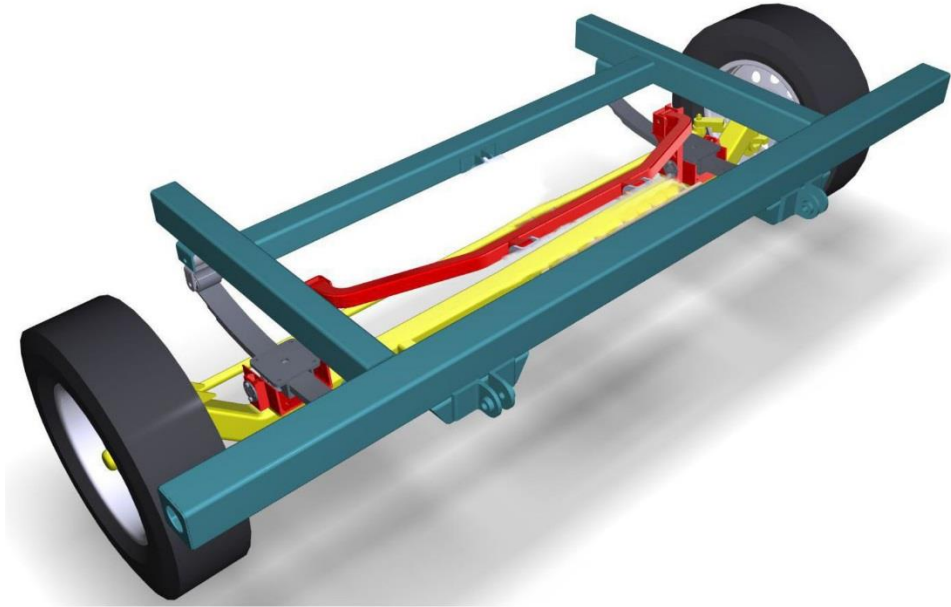


Trailwell-LD

Pivoting Platform Reversing Caster
Self-steer System (2000-2004)



APPENDIX D: The *Trailwell-HD* Samples



Trailwell-HD



